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ARMY'S FAILED PROGRAMS: MORAL IMPERATIVE FOR CHANGE

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ABSTRACT

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Throughout the previous decade, the Army has experienced a number of spectacular setbacks due to cancellations of its highly visible, high-dollar weapon systems. In 2002, Defense Secretary Donald Rumsfeld cancelled the Crusader program, the Army's next-generation self-propelled artillery system. A mere two years later in 2004, the Army cancelled the Comanche helicopter program, its largest aviation program, whose sophisticated detection and navigation systems were designed for armed scout missions at night and in all weather conditions. Most recently in 2009, the Defense Department made the decision to effectively cancel the Future Combat Systems program and drastically restructure the Army's most ambitious modernization program introduced over a decade ago by then Chief of Staff of the Army, General Eric Shinseki. Prior to their demise, these programs collectively invested over $30 billion without delivering their promised capabilities. Within the context of the new fiscal reality facing our nation, the Army simply cannot afford to repeat these costly missteps. The objective of this civilian research paper is to analyze the previously published reports and findings on these program failures and garner meaningful lessons for the Army.

ARMY'S FAILED PROGRAMS: MORAL IMPERATIVE FOR CHANGE

On May 22, 2009, at the signing of the Weapons Systems Reform Act, President Barack Obama stated the following as a part of his prepared remarks:

> As Commander-in-Chief, I will do whatever it takes to defend the American people, which is why I've increased funding for the best military in the history of the world…. But, I reject the notion that we have to waste billions of taxpayer dollars to keep this nation secure.[1]

Ever since that fateful morning on September 11, 2001, when the Americans witnessed the unimaginable horror of terrorist attacks coordinated and executed by the 19 suicidal al Qaeda hijackers, the American military has enjoyed overwhelming public support as its men and women shouldered the mission that began as the Global War on Terror. In fact, the Rasmussen Reports national telephone survey conducted in May 2010 showed 74% of Americans have a favorable opinion of the U.S. military whereas 12% hold an unfavorable opinion with 13% unsure.[2] For the past decade, the majority of American citizenry and its elected representatives shared President Obama's sentiment that the American military deserves nothing short of everything that it needs to fight the nation's wars.

The United States Army, more than any other military service, benefitted with substantial increases across all of its budget lines to include those for developing and procuring weapons systems. To support the Army at war, the paramount focus became the speed at which we develop and deliver the capabilities that the warfighters require on the battlefield. The Army implemented initiatives, such as Rapid Fielding Initiatives, to shorten the lag time, and created pseudo-acquisition entities, such as Rapid Equipping Force. Even the Office of the Secretary of Defense jumped on this bandwagon by creating the Joint Improvised Explosive Device Defeat Organization and

allowing it to operate outside the normal acquisition process. Meanwhile, the topic of efficacy of military spending has largely been absent from the dialogue within the Army. While the Army's Major Defense Acquisition Programs failed miserably one after another after investing billions of American taxpayer dollars, our responses seemed very much muted.

Throughout the previous decade, the Army has experienced a number of spectacular setbacks due to cancellations of its highly visible, high-dollar weapon systems. In 2002, Defense Secretary Donald Rumsfeld cancelled the Crusader program, the Army's next-generation self-propelled artillery system. A mere two years later in 2004, the Army cancelled the Comanche helicopter program, its largest aviation program, whose sophisticated detection and navigation systems were designed for armed scout missions at night and in all weather conditions. Most recently in 2009, the Defense Department made the decision to effectively cancel the Future Combat Systems program and drastically restructure the Army's most ambitious modernization program introduced over a decade ago by then Chief of Staff of the Army, General Eric Shinseki. Prior to their demise, these programs collectively invested over $30 billion without delivering their promised capabilities.

From economy to education to infrastructure, the United States now faces challenges that are fundamental and some would argue much larger than that of national defense against foreign extremists. To help the nation meet these challenges, the Army must do its part by aggressively moving forward in examining the shortfalls in its acquisition enterprise to identify and redress those systemic faults that can save billions of dollars for the American taxpayers. Within the context of the new fiscal reality

facing our nation, the Army simply cannot afford to repeat the costly missteps made during the last ten years. The objective of this civilian research paper is to analyze the previously published reports and findings on these program failures and garner meaningful lessons for the Army.

Fundamental Challenges Confronting Our Nation

Riding on the wave of renewed favorable public opinion and Congressional support, the American military saw its defense budget grow substantially from 2001 to 2010 expressed in FY11 constant dollars as shown below:[3]

DEPARTMENT OF DEFENSE BUDGET AUTHORITY BY TITLE (DOLLARS IN MILLIONS)										
	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10
MIL PERSONNEL	105,950	113,245	136,754	141,312	142,778	146,318	146,039	149,262	155,352	156,751
OPR & MAINT	159,126	179,751	228,315	233,887	210,052	240,225	262,455	269,668	284,009	277,814
PROCUREMENT	75,532	74,552	91,396	94,305	106,745	113,622	141,323	171,703	139,256	131,597
RDT&E	50,725	58,524	68,504	74,214	76,738	79,076	82,233	82,824	82,120	81,487
MIL CON	6,645	7,957	7,809	6,992	8,034	10,308	14,796	23,000	27,562	22,762
FMLY HSNG	4,479	4,866	4,959	4,430	4,563	4,797	4,276	2,959	3,947	2,294
REV & MGT FNDS	6,399	5,218	4,879	9,179	8,818	5,163	3,002	10,668	-1235	3,572
TRUST, RECEIPTS, & OTHER	-1,603	-2,024	-1,386	-601	-1,413	-2,710	-2,020	-1,604	-1,243	-1,628
TOTAL, FY11 CONSTANT $	407,253	442,088	541,228	563,717	556,315	596,800	652,106	708,480	689,768	674,648

Exhibit 1

Note: Totals include enacted budget authority and indefinite budget authority amounts, enacted OCO funding, and funding for the American Recovery and Reinvestment Act of 2009.

During this period, the Army's budget grew a staggering 160% from $101 billion in FY01 to $262 billion in FY08, before declining to $219 billion in FY10, which is still more than double where it started ten years ago.[4] Even as the American military as an institution enjoyed a favorable public opinion, the people of this war weary nation have grown increasingly tired of the military's prolonged engagements in Iraq and Afghanistan. Recent polls clearly echoed this declining support with roughly two-thirds of Americans opposed to the U.S. wars in Iraq and Afghanistan. The CNN/Opinion Research Poll conducted in September 2010 showed 65% opposed the U.S. war in Iraq with only 34% in favor.[5] The CNN/Opinion Research Poll conducted in December 2010 showed 63% opposed the U.S. war in Afghanistan with only 35% in favor.[6] Given their toll on our national resources, the American public's patience with these wars and their willingness

to continue funding them are clearly waning. The spotlight on the efficacy of America's military budget, which has been dimly lit if not mostly turned off since 9/11, will once again shine brightly as the budget debate heats up.

Further stoking this discontent, the national unemployment rate spiked sharply from 4.2% in January of 2001 to 10.1% in October 2009 finally abating slightly to 9.4% in December 2010 as reported by the Bureau of Labor Statistics.[7] The sharpest rise came within the last few years since January 2008 from the financial crisis triggered by the bursting of the housing market bubble. As the nation spent hundreds of billions of dollars in fighting the War on Terror while struggling to shore up the financial institutions to stop them from the brink of impending disaster, our national debt ballooned from $5.8 trillion in September 2001 to $13.5 trillion in September 2010 rapidly approaching the $14.3 trillion cap set by law.[8] The speed with which the United States will recover from the effects of the Great Recession and the right economic remedies to trigger a sustainable recovery are still largely unknown yet nonetheless hotly debated by the political parties. But, most economists agree that this recovery will be a long and difficult journey. Most recently on 26 January 2011, the Congressional Budget Office predicted the continuing weak economy and the bipartisan tax cut compromise reached during the lame duck

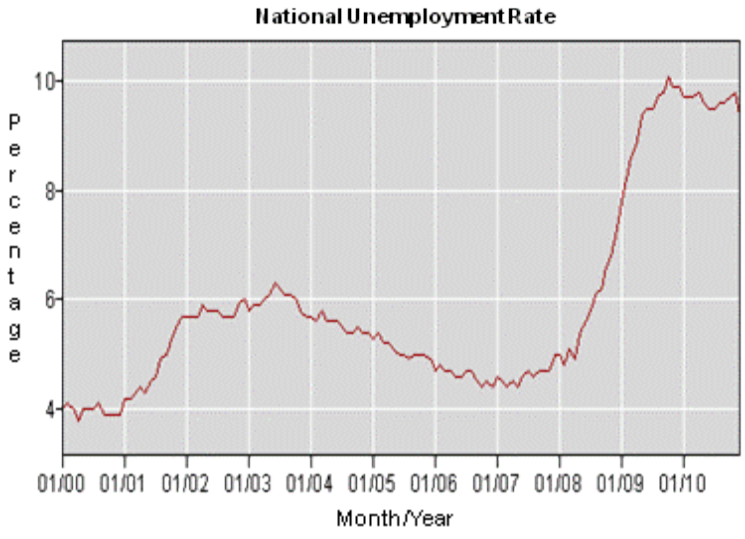


Exhibit 2

session of the Congress in December last year will contribute to a record deficit of $1.5 trillion this year.[9]

As dire as the current economic climate seems, it pales in comparison to the state of education in the United States. In December 2010, the New York Times reported how much the American educational system, once the envy of the world, has fallen. As shown herein, the Program for International Student Assessment (PISA) test results paint a grim picture. When compared to 65 countries, the United States scored slightly better than the average scores in science and reading test but well below the average score in mathematics test. The most alarming fact about these PISA test results is how most of our global economic competitors in Europe and Asia are better educating their students. In response to these results, Secretary of Education Arne Duncan stated, "We have to see this as a wake-up call."[10] Educating our children is the best investment that we can make as a nation to ensure our competitive edge globally. If these test results are any indication, then the United States is unfortunately on a path to losing that edge unless we as a nation make education once again our national priority.

An International Education Test

The Organization for Economic Cooperation and Development has released the results of its 2009 PISA (Program for International Student Assessment) test of 15-year-old students in 65 countries. In the Math and Science tests, all participating regions of China outperformed the United States.

SCIENCE	PISA SCORE
Shanghai, China*	575
Finland	554
Hong Kong, China	549
Singapore	542
Japan	539
Korea	538
New Zealand	532
Canada	529
Estonia	528
Australia	527
Netherlands	522
Taiwan	520
Germany	520
Liechtenstein	520
Switzerland	517
Britain	514
Slovenia	512
Macao, China	511
Poland	508
Ireland	508
Belgium	507
Hungary	503
United States	**502**
AVERAGE SCORE	501
Czech Republic	500
Norway	500
Denmark	499
France	498
Iceland	496
Sweden	495
Austria	494
Latvia	494
Portugal	493

READING	PISA SCORE
Shanghai, China	556
Korea	539
Finland	536
Hong Kong, China	533
Singapore	526
Canada	524
New Zealand	521
Japan	520
Australia	515
Netherlands	508
Belgium	506
Norway	503
Estonia	501
Switzerland	501
Poland	500
Iceland	500
United States	**500**
Liechtenstein	499
Sweden	497
Germany	497
Ireland	496
France	496
Taiwan	495
Denmark	495
Britain	494
Hungary	494
AVERAGE SCORE	494
Portugal	489
Macao, China	487
Italy	486
Latvia	484
Slovenia	483
Greece	483

MATH	PISA SCORE
Shanghai, China	600
Singapore	562
Hong Kong, China	555
Korea	546
Taiwan	543
Finland	541
Liechtenstein	536
Switzerland	534
Japan	529
Canada	527
Netherlands	526
Macao, China	525
New Zealand	519
Belgium	515
Australia	514
Germany	513
Estonia	512
Iceland	507
Denmark	503
Slovenia	501
Norway	498
France	497
Slovakia	497
AVERAGE SCORE	497
Austria	496
Poland	495
Sweden	494
Czech Republic	493
Britain	492
Hungary	490
Luxembourg	489
United States	**487**
Ireland	487

*In the study, China was represented by the city Shanghai and by the administrative regions Hong Kong and Macao.

Source: Organization for Economic Cooperation and Development

Exhibit 3

Shockingly, the state of our national infrastructure fares even worse. According to the most recent American Society of Civil Engineers' *2009 Report Card for America's Infrastructure*, our national infrastructure is in appalling state that requires an urgent and sizeable $2.2 trillion investment over five years to upgrade their poor condition to good.[11] The grades for fifteen categories shown herein are yet another distressing reminder of how much we have neglected these critical elements of our national infrastructure. What is more disheartening is all but one category, energy which improved its grade from D to D+, showed no progress since the last report in 2005.[12] Taken as a whole, our national infrastructure has worsened over the last decade since it received a collective grade of D+ in the 2001 report, and the total amount of investment dollars needed has significantly increased over the years. These facts paint a rather bleak picture of the formidable task we must take on as a nation and the size of capital investment required if we are to affect substantive and meaningful improvements in our quality of life.

ASCE Report Cards for America's Infrastructure over 10 Years			
CATEGORY	2001 GRADE	2005 GRADE	2009 GRADE
Aviation	D	D+	D
Bridges	C	C	C
Dams	D	D	D
Drinking Water	D	D-	D-
Energy	D+	D	D+
Hazardous Waste	D+	D	D
Inland Waterways	D+	D-	D-
Public Parks & Recreation	N/A	C-	C-
Rail	N/A	C-	C-
Roads	D+	D	D-
Schools	D-	D	D
Solid Waste	C+	C+	C+
Transit	C-	D+	D
Waste Water	D	D-	D-
COLLECTIVE GRADE	**D+**	**D**	**D**
Total Investment Needs	**$1.3 Trillion**	**$1.6 Trillion**	**$2.2 Trillion**

Exhibit 4

<u>Downward Pressure on Defense Budget</u>

The sharp increase in the defense budget during the previous decade clearly reflects where the United States placed defense in our national priority. Inside the halls of the Congress, the defense budget had remained a sacrosanct topic. In the past, most Congressional leaders, both Democrats and Republicans, remained reluctant to even entertain the idea of cutting the defense budget for the fear of painting their party "soft" on national defense to their constituents. Now, however, we are beginning to hear

different voices in the public discourse about the defense spending. The record unemployment rate, soaring national debt, declining educational system, and poor national infrastructure are only some of the external factors that have begun to exert a significant downward pressure on the defense budget.

While appearing on NBC's "The Today Show" in November 2010, a key Republican, then soon-to-be House Majority Leader Eric Cantor, stated on the record that everything, including the defense budget and entitlements, has to be on the table. In December 2010, the bipartisan National Commission on Fiscal Responsibility and Reform created by President Obama published its official report with its recommendations to address the nation's fiscal crisis. In this report, the Commission stated the following:

> As the Chairman of the Joint Chiefs of Staff, Admiral Mike Mullen, has noted, the most significant threat to our national security is our debt. The ability of the United States to keep our country secure over time depends on restoring fiscal restraint today.[13]

Although it failed to garner the 14 votes from its 18 members required to send the proposal forward officially to the Congress, the Commission put the defense budget on the table as a part of its $4 trillion deficit reduction plan.

In early January 2011, Defense Secretary Robert Gates announced a series of cost efficiencies totaling more than $150 billion to take effect throughout the Defense Department over the next 5 years. The Army's share, roughly $29 billion of the $100 billion Secretary Gates had instructed the military services to find, is expected to come as a result of savings from the following:[14]

- Terminating the SLAMRAAM surface to air missile, and the Non-Line of Sight Launch System, the next-generation missile launcher originally conceived as part of the Future Combat System;

- Reducing manning by more than 1,000 positions by eliminating unneeded task forces and consolidating six installation management commands into four;
- Saving $1.4 billion in military construction costs by sustaining existing facilities; and
- Consolidating the service's email infrastructure and data centers, which should save $500 million over five years.

In addition to these cost savings, Secretary Gates also stated, "In all, this budget proposal anticipates a total reduction of roughly $78 billion to the Five Year Defense Plan submitted last year."[15] Furthermore, Secretary Gate stated, "To maintain the kind of military needed for America's leadership role requires not only adequate levels of funding, but also fundamentally changing the way our defense establishment spends money and does business."[16]

Even as the downward pressure on the defense budget gains steam, the battle doesn't appear to be quite over. After the meeting with Secretary Gates, the new House Armed Services Committee Chairman, Buck McKeon (R-Calif.), expressed his concern thusly, "We are fighting two wars, you have China, you have Iran: Is this the time to be making these types of cuts?"[17] Meanwhile, our nation struggles with its abysmal fiscal outlook with the high unemployment rate as the debate over the size of federal budget continues. With a mounting federal deficit and ever growing national debt, the downward pressure on defense spending will only increase. Rather than being dragged by the Congress or the White House, the Army must lean forward and make a compelling case as to how it can adapt to the changing fiscal environment. The most critical step in the Army's adaptation to the impending fiscal austerity is its ability to examine and identify relevant lessons from recently failed programs. Only then, can we

hope to implement meaningful systemic changes to assure a more effective and efficient utilization of diminishing defense dollars.

The Crusader's Evolution Leading to Cancellation

During Operation Desert Storm, the Army discovered that its M109A2/A3 155-mm self-propelled howitzer (SPH) lacked sufficient operational capabilities in combat to keep pace with the armored tanks and infantry fighting vehicles. Drawing on these lessons, the US Army Field Artillery School validated the operational requirement for a new 155-mm SPH and its resupply vehicle (RSV) with significantly enhanced combat effectiveness derived from greater lethality, mobility, and survivability. The Crusader SPH and RSV started as continuation of the Advanced Field Artillery System and Future Ammunition Resupply Vehicle, which were part of the Army's Armored Systems Modernization program. In January 1995, the Crusader program received an acquisition directive from the Office of the Secretary of Defense (OSD) to evaluate the German PzH2000 155-mm SPH as an alternative solution. This OSD directive led to a series of meetings in 1996 by the Crusader program with the German PzH2000 contractor and the German army, who were seeking foreign buyers to potentially lower their procurement costs. "Although it may be possible to grow the PzH2000 system to meet Crusader requirements, the Army analyses suggested that this would not be the most efficient path to procure a system that meets Army requirements."[18]

Envisioned as the transformational artillery system, the Army expected its contractor team, led by United Defense Limited Partnership, to deliver its first Crusader prototype system in October 1999. The decision to enter into the low-rate initial production (LRIP), normally 10% of the total procurement quantity, was expected to occur in August 2003 with the full-rate production decision following two years later in

October 2005. From its inception, the Crusader program received a strong patronage from the Army leadership as demonstrated by their significant financial commitment.

> The Army estimates it will cost over $12 billion (in fiscal year 1995 constant dollars) to design and procure 824 Crusader howitzers and 824 Crusader resupply vehicles. The Crusader system unit cost is estimated to be $14.7 million (in fiscal year 1995 constant dollars)—$7.5 million for the howitzer, $5.8 million for the resupply vehicle, and $1.4 million that the Army could not divide between the two vehicles.[19]

The General Accounting Office (GAO) in its June 1997 review of the Crusader program strongly cautioned that the system's ambitious requirements pose significant "technical challenges" and "considerable programmatic risks" and recommended the OSD to direct the Army to establish stringent test criteria for demonstrating the system's key requirements to include reliability prior to authorizing the low-rate initial production and to ensure that the system is operationally effective and suitable prior to authorizing the full-rate production.[20] By February 2002 when the GAO issued another report, the Crusader program was restructured "to reduce individual vehicle weight from about 60 tons to about 40 tons so that two vehicles can be deployed on a C-17 aircraft" as an integral element of a more strategically deployable force as envisioned by the new Chief of Staff of the Army,

Comparison of the Crusader requirements to Paladin and PzH 2000			
Description	**Crusader requirement**	**Paladin capability**	**PzH 2000 capability**
Maximum rate of fire (rounds per minute)	10 to 12 (for 3 to 5 minutes)	4 (for 3 minutes)	10 (for 1 minute) (a) 8 (for 3 minutes) (a)
Sustained rate of fire (rounds per minute until system is out of ammunition)	3 to 6	1 to 2	3 (b)
Maximum range (kilometers)	40 to 50	30	40 (c)
Multiple round simultaneous impact (rounds impacting)	4 to 8 (between 8 and 36 kilometers)	2 (between 10 and 20 kilometers)	N/A (d)
Rearm time (minutes)	Less than 12	22	less than 11 minutes
Cross-country speed (kilometers per hour)	39 to 48	30	45
Highway speed (kilometers per hour)	67 to 78	67	61
Combat loaded weight (tons)	55	32	60
90-second survival dash speed (meters)	750	560	750
(a) Preparing the propellant charge is not included in the time. The PzH 2000 could not fire at this rate at targets located in the longer third of its range because it lacks active cannon cooling.			
(b) The PzH 2000 could not fire at this rate at targets located in the longer sixth of its range because it lacks active cannon cooling.			
(c) Has not been demonstrated.			
(d) As this is not a German requirement, the PzH 2000 has not attempted to fire such a mission. However, contractor officials believe that if the PzH 2000 had a propellant autoloader, it would have the same capability as the Crusader howitzer.			
Source: Army data for the first two columns and PzH 2000 contractor data for the third column.			

Exhibit 4

General Eric K. Shinseki.[21] Although some progress has been made in developing key technologies, the joint assessment conducted by GAO and the Crusader program office revealed that the program "will likely enter product development with the majority of its critical technologies less mature than best practices recommend."[22] Moreover, this report noted a potential overlap of capabilities as well as schedules between the Crusader and the Future Combat Systems (FCS), then in its very early stage of developing advanced technologies to perform artillery missions among others.

By May 2002, the Army had already invested nearly $2 billion of the expected total of $11 billion in development and procurement costs, and the number of systems expected to be built had been cut by over half to 480 from 1,138 for the active component and part of the Army National Guard.[23] Furthermore, the Crusader program had significantly fallen behind its original schedule. The program was scheduled for an April 2003 OSD review to decide whether it was ready to enter the system development and demonstration phase. The first Crusader prototype delivery slipped from October 1999 to October 2004, the LRIP decision scheduled for August 2003 was delayed to February 2006, and the system fielding originally expected to start in 2005 would not occur until three years later in 2008. In May 2002, Undersecretary of Defense for Acquisition Pete Aldridge requested the Army to submit a written assessment within 30 days outlining the alternatives to the Crusader.

However, within days of this request, Defense Secretary Rumsfeld announced that he "was recommending an amendment to the FY2003 DOD budget request terminating the Crusader program."[24] Citing operational lessons learned from the war in Afghanistan, he argued "that the Crusader was not designed to deliver precision fires

and he favored transformation investments in precision fires."[25] The Crusader cancellation became highly controversial as the program still enjoyed a full backing from the Army leadership, including Army Chief of Staff General Shinseki and Army Secretary White, as well as a bipartisan support from the Congress, including Senator Inhofe, R-OK, Senator Akaka, D-HI, and Senator Levin, D-MI. General Shinseki testified before the Senate Armed Services Committee "that precision weapons do not fulfill one important Crusader requirement, the ability to deliver, cost effectively, massed suppressive fires against close-in and imprecisely located enemy forces."[26] Ultimately, Defense Secretary Rumsfeld prevailed in this debate, and the Crusader program faced its demise after spending nearly $2 billion during its eight years of development.

The Comanche's Evolution Leading to Cancellation

The Comanche began in 1983 as the Army's Light Helicopter Experimental (LHX) program whose two versions (scout/attack and utility) were to be designed to share many common components in performing their utility, reconnaissance, and attack missions. Initially, the Army expected to procure a total of 5,023 helicopters (3,072 scout/attack and 1,951 utility) to replace its then current fleet of helicopters (AH-1 Cobra, UH-1 Huey, OH-6 Cayuse, and OH-58 Kiowa) that were rapidly becoming obsolete against the expected threat of the future battlefield. From its inception, the program faced significant technical challenges in its attempt to build the most technologically advanced helicopter with state-of-the-art avionics and lightweight composite airframe. By 1987, the flyaway costs for both aircraft versions had risen by 15% from $6 million to $6.9 million for the scout/attack helicopter and by 35% from $4 million to $5.4 million for the utility helicopter.[27] Based on research that showed overwhelming pilot workload for one person, the Comanche program opted in 1987 to

develop a two-seat aircraft (one pilot and one copilot/gunner) rather than a single-seat aircraft originally envisioned. Five years into the program in 1988, the Army "dropped the utility version of the aircraft and also reduced the planned acquisition quantity from 5,023 in 1985 to 2,096."[28]

In May 1992, the GAO published another caustic report on the Comanche program after its extensive review that lasted over 16 months from October 1990 to February 1992. Among its findings, the GAO made this statement that put a bright spotlight on the Comanche's role in the Army aviation.

> The Army has concentrated its design efforts on making the Comanche a sophisticated multi-mission aircraft with attack capabilities comparable to or more advanced than the AH-64 Apache – the Army's premier attack helicopter.[29]

Conceived and designed as a scout/attack helicopter, the Comanche's true primary role was that of reconnaissance, flying ahead of the Apache to scout targets. Given the Comanche's expected lethality and the Apache's demonstrated capability to fly "long-range reconnaissance missions during the Operation Desert Storm," the Army had inadvertently "blurred the distinction between the two aircraft's roles."[30] This unintended competition and perceived duplication between the two aircraft's roles and their capabilities did not bode well for the Comanche's success, especially since the Apache already had a proven record of combat success. Against the backdrop of a drastically changed threat environment with the collapse of the Soviet Union and the Warsaw Pact and the American public's expectation of a peace dividend, the Comanche's future looked very much uncertain.

More troubling was the Comanche's estimated unit cost that continued to climb: $12.1 million in 1985; $19.1 million in 1988; and $27.4 million in 1991. This represented

a 125% increase over a span of six years. Meanwhile, the expected procurement quantity decreased drastically: 5,023 in 1985; 2,096 in 1988; and 1,292 in 1991. The GAO report also cautioned against the technical risks remaining in the development of the Comanche's mission equipment package, which is largely driven by complex software functions to provide navigational, communication, and target acquisition capabilities. These software development and integration challenges combined with the Army's plan "to incorporate Longbow radar and missile on about one-third of its Comanche helicopters" and the need for a "power upgrade of about 12 percent to compensate for increases in the Comanche's weight" posed a significant risk for further cost growth in the future.[31] Also, the GAO report recommended that the Army reexamine and revise its unrealistic estimate of 2.5 maintenance man-hours per flight hour given that the Comanche has "76 percent more avionics than the Cobra" whose demonstrated maintenance rate was 10.22 man-hours.[32] Underestimating the maintenance requirement would negatively affect the Comanche's flying hours or force the Army to increase its maintenance capacity with additional manpower, thus drastically increasing the Comanche's operations and support costs.

In August 1999, the GAO published yet another report on the cost, schedule, and performance status of the Comanche program in response to the Army's plan to move up the engineering and manufacturing development phase 19 months earlier to March 2000. The key reason for this restructured plan was to enable the delivery of 14 Comanche helicopters for initial operational capability by the end of 2006; however, it contradicted the Army's previous development plans that "called for the mission equipment package to be integrated and tested on a prototype helicopter" before

entering the engineering and manufacturing development phase.[33] Since the program's inception, the technology maturation of the Comanche's mission equipment package and associated avionics remained a major concern and added greatly to the overall program risk. Further exacerbating the program risk, this restructured plan compressed the Comanche flight-test schedule that was already "behind schedule because of periodic developmental problems and funding constraints" only having completed 128 flight-test hours of the scheduled 174 flight-test hours.[34] Nonetheless, the Army implemented its restructured plan, and two years later in June 2001, the GAO published a follow-up report that stated the following:

> Since our August 1999 review, the Comanche program's estimate cost has increased significantly – from $43.3 billion to $48.1 billion – and costs are expected to increase further. In addition, the Comanche continues to experience scheduling delays and performance risks.[35]

Witnessing these consequences of entering into "development too early in terms of technology readiness, which is contrary to the best commercial best practices," the Comanche program officials readily acknowledged that "the program cost and schedule objectives are not achievable and should be changed to reflect more realistic objectives."[36] Surprisingly, these same officials believed that addressing these programmatic changes could wait 18 months until the next OSD review of the Comanche program scheduled for January 2003.

In October 2002, Pete Aldridge, Under Secretary of Defense for Acquisition, Technology, and Logistics signed an acquisition decision memorandum after a Defense Acquisition Board review of the Comanche program. With this memorandum, Secretary Aldridge approved yet another restructuring of the program that cut the total number of Comanche helicopters to be purchased to 650 and pushed out the initial operational

capability until 2009, three years later than the Army's previous plan.[37] Secretary Aldridge also authorized an additional "$3.7 billion to the helicopter's $3.2 billion full-scale development program."[38] In February 2003, Acting Secretary of the Army Brownlee and the Chief of Staff of the Army, General Schoomaker, held a joint new conference to announce their recommendation "that the Comanche helicopter program be terminated and those resources reallocated to restructuring and revitalizing Army aviation."[39] In May 2003, the Defense Department's Inspector General published its thorough review of the Comanche program. In this report, the Inspector General noted that the analysis of the independent cost estimates from the Cost Analysis Improvement Group indicated the average unit cost of a single Comanche helicopter would have increased to $41.8 million based on the October 2002 restructuring plan.[40] Up until its cancellation, the Comanche program had cost the American taxpayers over $7 billion over a span of more than 20 years, with no more to show for the effort other than two prototype aircraft.

The Future Combat Systems' Evolution to Cancellation

The genesis of the Future Combat Systems (FCS) goes back to October 1999 when then Chief of Staff of the Army, General Shinseki, introduced the Army's transformation strategy. His vision was to transform the entire Army by 2032 starting with its first FCS operational unit in 2011 equipped with smaller, agile, and more rapidly deployable ground and air vehicles with highly advanced offensive, defensive, and communications/information capabilities in order to gain a decisive advantage on the future battlefield. General Shinseki leaned on the Defense Advanced Research Projects Agency (DARPA) to initiate the FCS program, "not only because of its proven ability to manage highly conceptual and scientifically-challenging projects," but also

because he wanted to avoid any early resistance from the Army's senior leadership still entrenched in the heavy, armored doctrinal world.[41] Among the four industry teams originally selected to develop FCS designs in 2000, Boeing and Science Applications International Corporation (SAIC) emerged in 2002 as "the lead systems integrators" responsible for overseeing "the development of the FCS's 18 original systems."[42] The Army took a full ownership from DARPA in 2003 with the Defense Acquisition Board's approval to move the FCS program into the system development and demonstration phase despite the GAO's warning that most of the 31 FCS critical technology areas were assessed immature by best practice standards.[43]

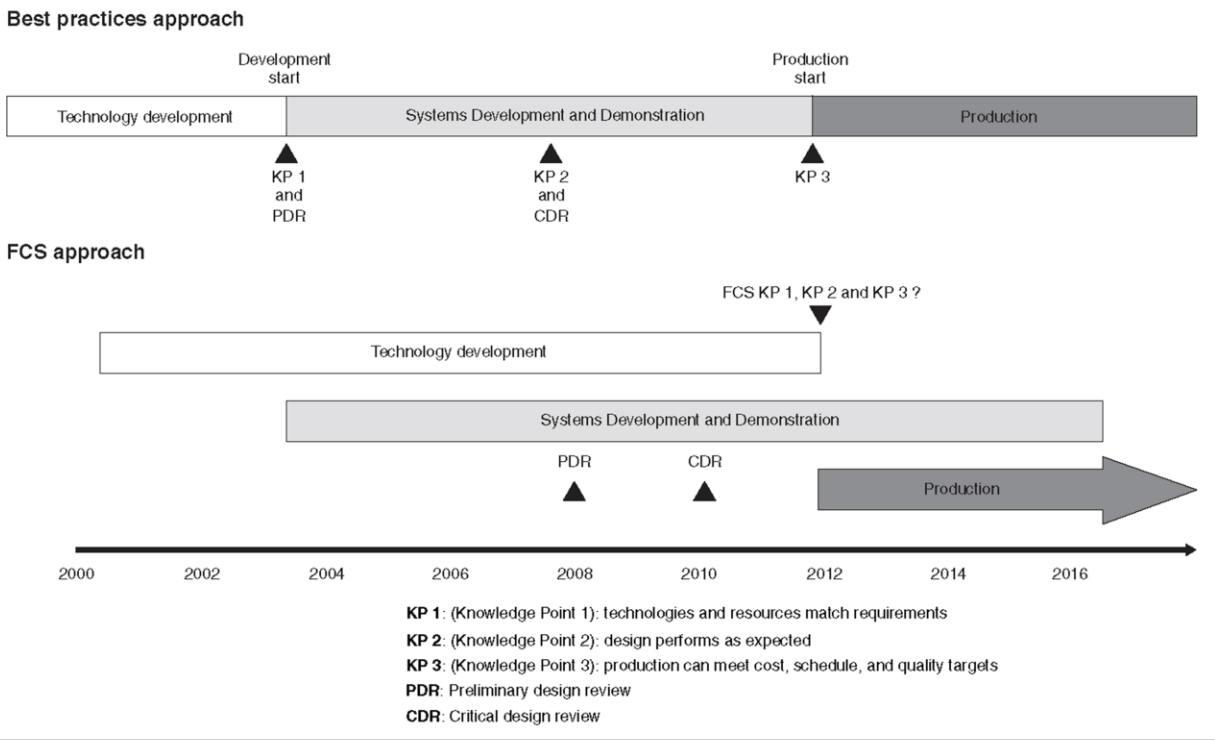
In July 2004, General Schoomaker, then Chief of Staff of the Army, made a major restructuring with a number of changes to the FCS program. These changes included fielding advanced FCS technologies to the current force sooner, addressing the Congressional interest to field the Non-Line-of-Sight Cannon by 2010, fielding all 18 FCS systems whereas only 14 were funded previously, increasing the schedule by four years, and designating an evaluation brigade to test developed FCS capabilities.[44] The primary objective behind this restructuring was "to get relevant technologies into the hands of soldiers fighting in Iraq and Afghanistan as soon as they became available as opposed to letting them sit on the shelf until they could be integrated into other systems."[45] However, those who remain critical of the restructuring argued these changes added $28 billion to the already bloated $90 billion program budget that was already under Congressional scrutiny.[46]

Meanwhile, the FCS program's ability to mature its critical technologies continued to struggle. Within the science and technology as well as the acquisition communities,

technology readiness levels (TRL) are used to assess the maturity of technology. TRL 6 involves a system/subsystem model or a prototype demonstration in a relevant environment. When a system prototype is demonstrated in an operational environment, TRL 7 is achieved. The true end of system development occurs at TRL 8 when the actual system has undergone test and demonstration. In 2003, "87 percent of FCS's critical technologies were projected to be mature to a TRL 6 by 2005."[47] This figure had fallen precipitously to 31 percent by 2005 when the program was reviewed by the General Accounting Office.[48] This lack of progress clearly indicated that the FCS program had grossly overestimated its ability to mature the critical technologies.

The GAO review also noted the Army's high risk approach in its FCS acquisition strategy with "concurrent development, design reviews occurring late, and other issues out of alignment with knowledge-based approach outlined in DOD policy."[49] This approach, when compared with commercial best practices' approach, carried an inherently higher risk that would lead to discovering a considerable number of technical problems, both design related and development related, late in the acquisition cycle. Ultimately, this risky approach, if not managed rigorously, would result in a large amount of unanticipated rework needed to overcome problems, contributing to additional cost overruns and schedule delays. In 2006, the GAO reported that the total cost for the program "has climbed 76 percent from the Army's first estimate" of $91.7 billion to $160.7 billion.[50]

Figure 2: FCS Acquisition Compared with Commercial Best Practices' Approach



Source: U.S. Army (data); GAO (analysis and presentation).

Exhibit 5

When the GAO published its 2007 report, it cast an even darker cloud over the FCS program's future. The GAO reported, "While the Army's current estimate of $163.7 billion is essentially the same, an independent estimate from the Office of the Secretary of Defense puts the acquisition cost of FCS between $203 billion and $234 billion."[51] Even at its low end, this range of independent cost estimates represented an appalling increase in excess of 120% percent from the FCS program's original cost estimate. Further fueling the fire, the GAO added, "The comparatively low level of technology and design knowledge at this point in the program portends future cost increases."[52] If it had not been one already, the FCS program was quickly becoming a financial albatross destined to be an outsized drain on the Army's entire budget with no end in sight. At the same time, the maturation of critical technologies for FCS seemed to worsen. By 2008,

the GAO discovered “only two of FCS’s 44 critical technologies have reached a level of maturity” required to begin system development.[53] With the preliminary design review and the subsequent OSD go/no-go milestone decision only one year away in 2009, all indicators for future program success seemed to blink bright red.

In March 2009, the GAO published yet another scathing report on the FCS program execution, which seemed to all but lay the program in its casket. It warned that “the FCS program may not be executable given the amount of development budget remaining and the development work that remains to be done.”[54] The program had already spent nearly 60% of its estimated $164 billion budget, and “the Army would

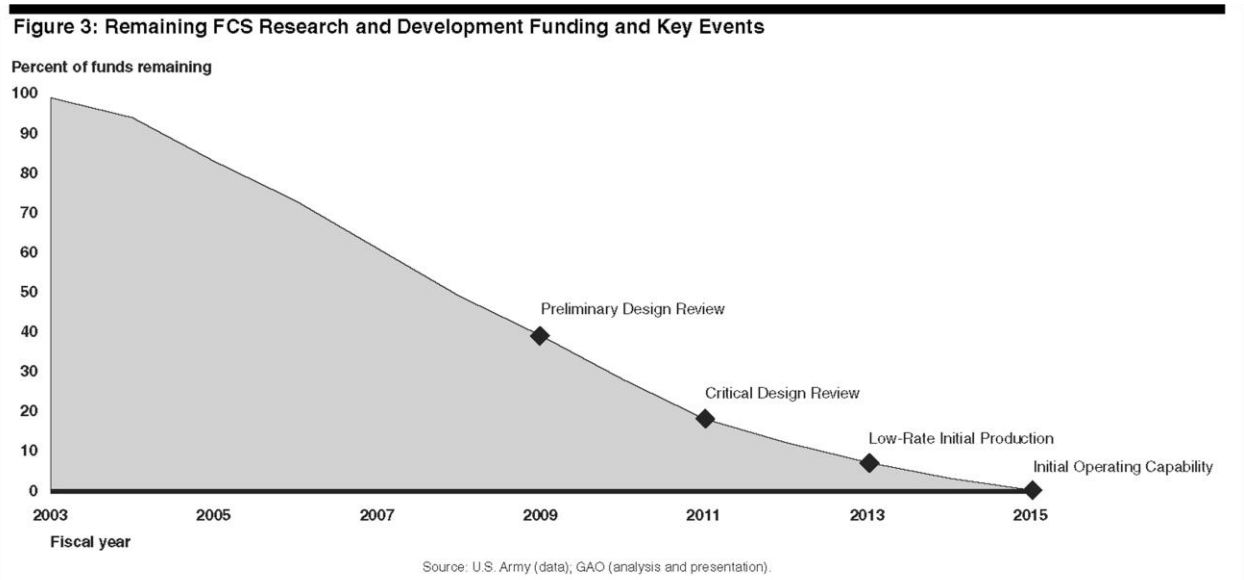


Exhibit 6

have to complete development – in essence, the entire system development phase – with 40 percent of its financial and schedule resources remaining.”[55] A month after the issuance of the GAO report, Secretary Gates announced his intention to stop the FCS program by cancelling its most costly elements along with other deep cuts in many of the Pentagon’s conventional weapons programs. This announcement was shortly followed by Under Secretary of Defense for Acquisition, Technology, and Logistics

Ashton Carter's formal acquisition decision memorandum in June 2009 that terminated the FCS manned ground vehicle components and transitioned the surviving components to Army Brigade Combat Team Modernization program. Almost two years after its cancellation, the full story of FCS is still unfolding as the Army tries to salvage its remnants together. But, one fact stands out – after 6 years and an estimated $18 billion, its return on investment remains questionable at best.

Conclusion

As the author of this paper, I intentionally decided to focus my research on an area of which I would not bring personal nor professional bias. Throughout the entire process, my research objective was guided by a need for personal learning as well as professional yearning to contribute any relevant lessons to the overall good of the acquisition community and of the Army. I brought no prior prejudicial knowledge on these programs that might have cast a shadow on the lens through which I wanted to critically examine their shortcomings. All large, complex institutions have a proclivity to rationalize their failures in blaming external factors rather than accepting internal reasons. The Army is no exception as we sometimes fall victim to this trap of laying the blame on the foot of others rather than our own. We blame the acquisition system for being too cumbersome, too unresponsive, too expensive, too lengthy, and really too much of everything that is not good. All of these may be entirely true, partially true, or not true at all depending on who you are and where you are in relation to the failures and their perceived causes. If you are inside, then the instinctive reaction is to look at external factors to assign the culpability.

Pouring through the countless previously written materials on the Army's failed programs through the various stages of their respective evolution, I wondered early in

my research whether a common thread that binds their failures could be found. At times, the task seemed too daunting as so much has been written about these three programs from their promising beginnings to their disappointing endings. Through my informal discussions with a number of Army senior officials, both military and civilian, I've been told that the reasons for each program's failure are distinctly different from those of others. I questioned that premise, and my research led me to believe it is not entirely true. Undoubtedly, there were many contributing factors to these programs' failures, but collectively their stories share a common thread. A preeminent factor that cracked the foundation on which each of these programs was built exists. All these programs failed because of their technology over-reach. The Army wanted what it wanted with untamed optimism for technical feasibility.

So, how does the Army fundamentally change the way it does its business and spends taxpayers' money as called upon by Secretary Gates? This great nation of ours is at a crossroad. All indicators that used to signal our nation's prosperity and success on the global stage are now warning us to change course before it's too late. Herculean tasks lie ahead as we must once again create a robust economy, rebuild a strong national infrastructure, and cultivate a well-educated populace. Changes in laws, policies, or regulations cannot accomplish these tasks alone – all will require sizeable fiscal commitments. Upon assuming the reign as the new Chief of Staff of the Army, General Martin E. Dempsey stated in his memorandum to the Army, "We are uncertain about the future. The missions in Iraq and Afghanistan appear to be stabilizing. The Nation's economic condition appears to be declining. Senior leaders are questioning our role."[56] Our institutional track record, in terms of delivering major weapons systems,

nosedived to an abysmal level within the past decade. The obvious unsustainability of the military's spending habits is not lost on the consciousness of the American public and the civilian leadership. The looming national fiscal crisis cannot be solved without deep cuts in our nation's military budget. It is time for the Army to look at itself and find the fault within – we have an insatiable appetite for technology. We can ill afford to continue our past sins, wasting the hard earned American taxpayers' dollars on programs destined to fail because the technology won't be there to bring about their success. To those who would continue to argue that much good has come out of these failures, I say that may be so but we could have done much better. Saying we tried our best is not good enough any longer. It's time to set the bar much higher. The Army must not start even a single program without an absolute certainty that we know we can deliver. We must strive to renew a climate of trust and confidence in the Army's ability to execute and deliver on our promises. We owe no less to the American public.

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